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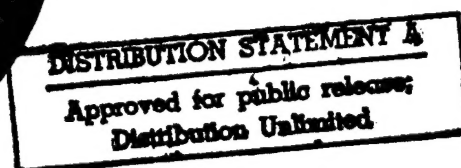
REPORT NO. 3-92

ELECTROCARDIOGRAPHIC MONITORING DURING
HYPERBARIC MEDICAL TREATMENTS
USING A THROUGH HULL ELECTRICAL PENETRATOR

LT R.B. GIEDRAITIS, MC, USNR
MR. JAMES W. MCCARTHY
MR. JAMES R. BRAUN

DECEMBER 1992

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DEPARTMENT OF THE NAVY
NAVY EXPERIMENTAL DIVING UNIT
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I. INTRODUCTION

The safe application of continuous electrocardiographic (ECG) monitoring of a seriously injured patient during a hyperbaric treatment is a useful means of assessing the patient's cardiac status. Because of elevated partial pressures of oxygen at depth, the use of ECG monitors inside the chamber is a potential fire risk. Reference (a) recommends that every effort should be made to remove flammable and hazardous materials from the chamber. Reference (b) also warns against the use of the Lifepak monitor in potentially explosive or flammable environments. In addition, mercury contained within the monitor's cathode ray tube is a potential contaminant to the chamber environment and cannot be allowed inside.

To circumvent the potential hazards of using the ECG monitor inside the chamber at depth, a through hull penetrator can be used to connect the monitor from outside the chamber to leads attached to the patient inside the chamber. The Lifepak 5, 6, and 9 are discussed in this report as they are the most widely used ECG monitors in the U.S. Navy, but the same techniques can be adapted for use with other monitors. This paper will not address the use of the Lifepak 5, 6, or 9 as a defibrillator in the hyperbaric environment.

Because of the many configurations of recompression chambers in existence, along with the wide variety of sizes and physical locations of through hull penetrators, the exact selection of parts for every chamber cannot be made. The actual wiring diagram in Appendix A supports the installation of a Conax 3/4-inch NPT full coupling hull penetrator. If the chamber has a larger size hull penetrator than 3/4 inch, the use of a reducing bushing, both inside and outside to facilitate the use of this design is permissible. If the chamber has a 1/2-inch hull penetrator, use the Conax Connector, part number PL-18-4B in place of the Conax PL-18-12B.

II. METHODS

A. EQUIPMENT

1. Electrical connector (Model PL-18-12B, Conax, Amron International)
Pressure specification: Vacuum - 2500 psi
Rated: 600 volts to 85 amps
2. Utility Boxes (quantity 2): BUD P/N CU-234.
3. Inside Receptacle: (Model P/N 801050-02, Physio-Control) for mating inside the chamber with EKG cable assembly (Model P/N 9-10418-02, Physio-Control).
4. External Receptacle: Standard three conductor audio receptacle (P/N 12B Switchcraft) for mating outside the chamber with monitor cable assembly (Model P/N SVC-C-409).
5. Three-fourths inch electrical conduit locking nuts (quantity 4).
6. Three-fourths inch short pipe nipple.

A supplier source list is included in Appendix B.

B. ACQUISITION AND INSTALLATION

Installation of the penetrator to the chamber and its connection to the utility boxes will require hand tools. Soldering of wire connections will be required. Questions regarding the installation of the system or modification for monitors can be directed to the Hyperbaric Department, Navy Experimental Diving Unit (phone: Commercial 904-230-3100 or DSN 436-4351).

III. CONCLUSIONS

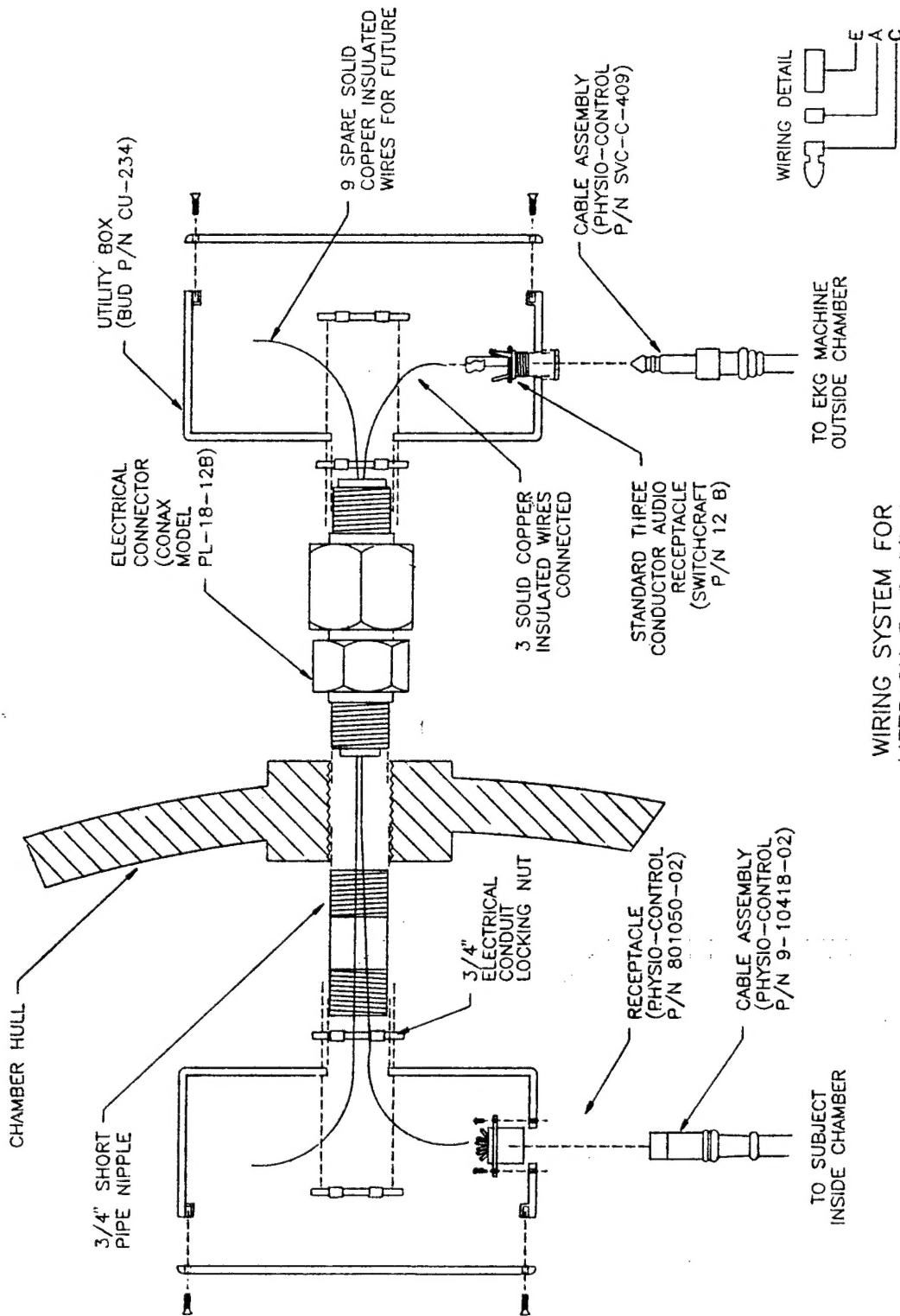
NEDU, using standard off-the-shelf components, designed a hull electrical penetrator assembly for electrocardiographic (ECG) monitoring. The assembly was tested and it met all performance and safety criteria. This chamber modification will allow ECG monitoring of a patient during treatment in a hyperbaric chamber.

REFERENCES

1. *U.S. Navy Diving and Hyperbaric Systems Safety Certification Manual*, Appendix B; NAVSEA 1987, SS521-AA-MAN-010.
2. *Lifepak 5 Operating and Service Manual*, 1988; Physio Control, Redmond, Washington.

APPENDIX A

FIGURE 1



WIRING SYSTEM FOR
LIFEPACK 5, 6 OR 9
EKG SYSTEMS
(EKG.DWG)

APPENDIX B
SUPPLIER SOURCE LIST

Physio Control Company
P.O. Box 7006
Redmond, Washington 98073-9706

Source for all parts
listed with Physio Control
part numbers

Newark Electronics
Administration Office
Ravenwood Ave
Chicago, Illinois 60640-4496
312-784-5100 (Phone)
312-638-7652 (Fax)

This is the corporate office for
Newark Electronics and source 4801 N.
for the name, phone number and
address of the nearest supplier of
Bud Utility Boxes and Switchcraft
Receptacles

Amron International
759 Fourth Ave
Escondido, California 92025-4089
619-746-3834 (Phone)
619-746-1508 (Fax)

Source for Conax Connectors

Any local electrical supply company

Source for electrical conduit
locking nuts and short nipples